Stated Preference Modeling of the Demand for Ohio River Shipments

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Introduction

- Previous shipper demand studies
  - Anderson and Wilson (2004, 2005A, 2005B)
    - Full spatial equilibrium model
    - Multiple areas of responsiveness to rate changes
      - Choices of mode, market, intensity of production, and the level of production
  - Train and Wilson (2004)
    - Upper Mississippi & Illinois River Basins (UMISS)
    - Responsiveness to rate changes
      - Choices of mode, location, quantity

Objective

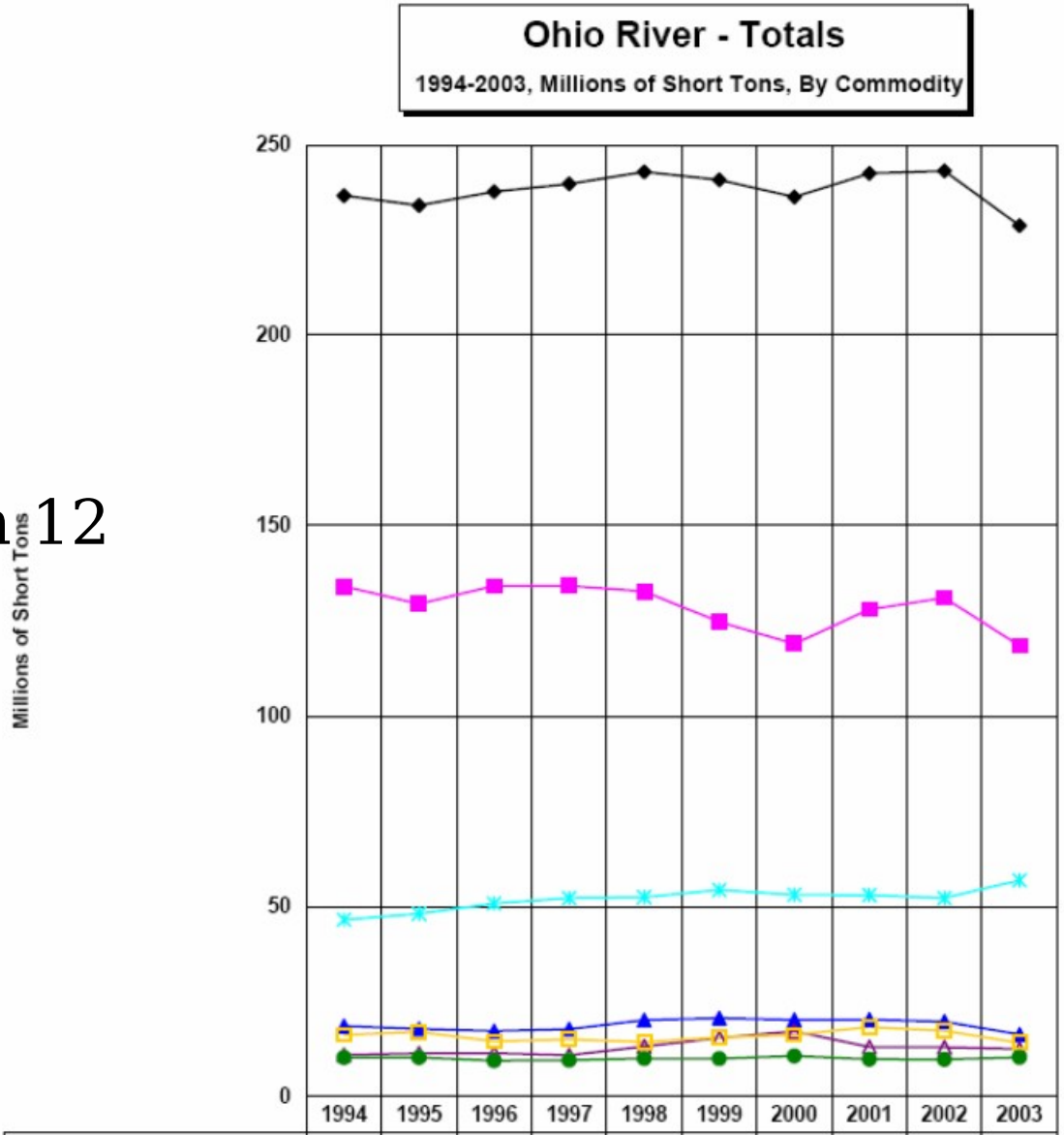
- UMISS parallel examination of Ohio River
- One source of responsiveness – production decisions
- Stated preference modeling
- Empirical estimates of elasticities

Outline

- Ohio River Resources
- Survey and data description
- Conceptual framework
- Econometric methodology
- Estimation Results
  - For transportation rate increases
  - For transit times increases

Ohio River Resources

- ORB covers nine states
- Barge routes span 12 other states



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total	236.65	234.06	237.69	239.76	242.90	240.79	236.30	242.50	243.15	228.77
Coal	134.02	129.46	134.14	134.19	132.69	124.75	118.93	128.00	131.04	118.46
Petro & Petro Products	18.59	17.84	17.27	17.75	20.16	20.64	20.19	20.28	19.75	16.38
Crude Materials	46.49	48.05	50.76	52.21	52.42	54.28	53.02	52.93	52.22	56.85
Manufactured Goods	10.98	11.39	11.47	10.91	13.20	15.49	17.19	13.08	13.00	12.58
Food & Farm	16.25	17.04	14.58	15.07	14.39	15.60	16.23	18.34	17.33	14.17
Other	10.32	10.29	9.47	9.62	10.04	10.02	10.73	9.86	9.81	10.34

Survey and Data Description

- Center for Business and Economic Research (CBER) telephone survey
  - 972 shippers contacted, 191 interview, 179 used
- Survey Instrument
  - Revealed and stated preference data
  - Mode/location vs. production choices

Survey and Data Description (cont.)

- 46 barge shippers
  - Representative of population (table)
- Location of shippers by state
  - 98% of states from ORB (table)
- Last shipment characteristics (table)
- Availability of loading equipment
  - 43% of truck equipment alone
  - 47% in combination w/ barge and rail equipment (table)
- Availability of alternatives
  - 70% have no options (table)
- Percentage of adjustment (table)

Conceptual Framework Baumol & Vinod (1970)

$$C = R(q, Q, Z)*Q + h(Z, q)*Q + I(q, Q, Z)$$

- Q - the total volume of annual shipments
- Z - the vector of transport mode characteristics
- $R(q, Q, Z)$ - transportation cost per unit of commodity shipped
- $h(Z, q)$ - freight handling costs of loading, unloading, and transhipments
- $I(q, Q, Z)$ - inventory costs

$$Q^* = Q(q, Z, \frac{\partial R}{\partial Q}, \frac{\partial I}{\partial Q})$$

Conceptual Framework (cont.)

- Cobb-Douglas functional form

$$Q_0 = A_0 x_0^{\alpha} r_0^{\beta} \qquad \& Q_1 = A_0 x_0^{\alpha} r_1^{\beta} = A_0 x_0^{\alpha} r_0^{\beta} (1+\Delta)^{\beta}$$

  - A_0 - all non-shipment characteristics related effects
  - x_0 - a set of shipper and shipment characteristics
  - r_0 - transportation rates
  - α and β - elasticities with respect to *x* and *r*

- Change in shipment volumes and rates

$$\frac{Q_1}{Q_0} = (1+\Delta)^{\beta}$$

Econometric Model

- Elasticity independent of shipment characteristiβs:

$$\log(\frac{Q_1}{Q_0}) = \beta \log(1+\Delta) + \varepsilon$$

- Elasticity as a function of shipment ch$\beta = \beta(x_0) = \beta_1 + \beta_2 x$

$$\log(\frac{Q_1}{Q_0}) = \beta_1 \log(1+\Delta) + \beta_2 \log(1+\Delta) x_0 + \varepsilon$$

Econometric Methodology

- Truncated dependent variable
  - Range of $\frac{Q_1}{Q_0}$: 0 to 1
  - Tobit Model
- Elasticity variation by mode & commodity
- Potential endogeneity
  - Most shippers have no alternatives
  - Robustness check

Estimation Results for Transportation Rate Increase

- Tobit Regression Results:
  - Barge shippers, coal & manuf. goods less responsive (table)
- Rate Elasticity by Commodity and Mode
  - Higher rate changes change the prob. of adjustment (table)
- Probabilities of Adjustment with Respect to Rate Changes For Barge Users
  - Increases with higher rate changes (graph)

Estimation Results for Transportation Rate Increase

- Tobit regression results
  - Crude material shippers are less responsive (table)
- Time elasticity by commodity and mode
  - Similar to rate elasticities, but smaller (table)
- Probabilities of Adjustment with Respect to Time Changes For Barge Users (graph)

Summary

- Stated preference approach
- Estimated responsiveness of production decisions to changes in rates and times
- Tremendous differences across commodities and shipper characteristics